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# Shooting the Moon: A Look at Lunar Laser Ranging and what it tells us about the Earth-Moon system and the interior of the Moon.

For more than a century, scientists have known that the interplay between gravity and rotation of the Earth and Moon can lead to measurable changes in the motions of the Earth-Moon system. In addition to causing the twice per day tides we see in the oceans, these interactions are forcing the rotation of the Earth to slow down (the Earth doesn't turn once every 24 hours!) and are causing the Moon to gradually recede from the Earth.

During the Apollo Moon landings, astronauts positioned specially designed reflectors on the surface of the Moon. A small number of ground stations, such as the McDonald Observatory in Fort Davis, Texas, are equipped with powerful lasers and optical telescopes and can literally shoot the Moon, bouncing the laser beam off of the lunar reflectors back to the waiting telescopes on the Earth. These Lunar Laser Ranging (LLR) stations allow us to very accurately measure the Earth-Moon distance and determine, among other things, how fast the Moon is moving away from us.

This presentation will review the physics behind the interactions that modify the behavior of the Earth-Moon system, examine how the past 30 years of accurate LLR measurements have refined our understanding of the processes involved, and highlight current research efforts at the Jet Propulsion Laboratory (JPL) that use LLR measurements to suggest that the inside of the Moon may be different from what everyone assumed it would be. The presentation will conclude with ways in which students (and faculty) can become involved with research projects at JPL.